

**Section 4.8 METHODOLOGY USED IN ESTIMATING EMISSION RATES
FOR VEHICLES CERTIFIED TO THE LEV_I STANDARDS**

This section discusses how the basic emissions rates in grams per mile were estimated for vehicles certified to the Low Emission Vehicle phase 1 (LEV_I) emission standards.

4.8.1 Introduction

In 1990 the California Air Resources Board (CARB) adopted a proposal that required manufacturers to produce vehicles, beginning with the 1994 model year, that met the LEV_I standards. Table 4.8-1 shows the LEV_I standards for vehicles tested using the Federal Test Procedure.

Table 4.8-1 LEV I Standards (grams per mile)

Vehicle Class	Emission Category	grams per mile		
		NMHC	CO	NOx
Passenger Cars & Light-Duty Trucks	TLEV	0.125	3.40	0.40
	LEV	0.075	3.40	0.20
	ULEV	0.040	1.70	0.20
Light-Duty Trucks 3751-5750 lbs (T2)	TLEV	0.160	4.40	0.70
	LEV	0.100	4.40	0.40
	ULEV	0.050	2.20	0.40
Medium-Duty Trucks 3751-5750 lbs (T3)-M2	LEV	0.160	4.40	0.40
	ULEV	0.100	4.40	0.40
Medium-Duty Trucks 5751-8500 lbs (T3)-M3	LEV	0.195	5.00	0.60
	ULEV	0.117	5.00	0.60

The notation used in this memorandum is:

TLEV = Vehicles certified to the Transitional Low Emitting Vehicle (TLEV) standard as defined in CARB’s 1990 LEV regulation.

LEV = Vehicles certified to the Low Emission Vehicle (LEV) standard as defined in CARB’s 1990 LEV regulation.

ULEV = Vehicles certified to the Ultra Low Emission Vehicle (ULEV) standards as defined in CARB’s 1990 LEV regulation.

Table 4.8-2 shows the suggested implementation schedule in order to meet the fleet average Non-Methane Organic Gas (NMOG) standard.

Table 4.8-2 Implementation Schedules for Vehicles Certified to the LEV I Emission Standards

Passenger Cars & Light-Duty Trucks <3750 lbs					
Model Year	Other	TLEV	LEV	ULEV	ZEV
1994	90	10	0	0	0
1995	85	15	0	0	0
1996	80	20	0	0	0
1997	73	0	25	2	0
1998	48	0	46	6	0
1999	23	0	71	6	0
2000	0	0	94	6	0
2001	0	0	85	15	0
2002	0	0	80	20	0
2003	0	0	75	15	10
Light-Duty Trucks 3751-5750lbs					
Model Year	Other	TLEV	LEV	ULEV	ZEV
1994	90	10	0	0	0
1995	85	15	0	0	0
1996	80	20	0	0	0
1997	73	0	25	2	0
1998	48	0	46	6	0
1999	23	0	71	6	0
2000	0	0	94	6	0
2001	0	0	85	15	0
2002	0	0	80	20	0
2003	0	0	80	20	0
Medium-Duty Trucks 5751-8500 lbs					
Model Year	Other	TLEV	LEV	ULEV	ZEV
1994	100	0	0	0	0
1995	100	0	0	0	0
1996	100	0	0	0	0
1997	73	0	25	2	0
1998	48	0	50	2	0
1999	23	0	75	2	0
2000	0	0	98	2	0
2001	0	0	95	5	0
2002	0	0	90	10	0
2003	0	0	85	15	0

4.8.2 Methodology

In EMFAC2000, technology groups 21, 22, 23 and 24 represent multi-point fuel-injected vehicles certified to the LEV_I standards. Table 4.8-3 shows the technology group definitions.

Table 4.8-3 LEV I Technology Groups

Groups	Technology Group Definitions
21	TLEV, Three-Way Catalyst, MPFI
22	TLEV, Three-Way Catalyst, MPFI with OBD2
23	LEV, Three-Way Catalyst, MPFI with OBD2
24	ULEV, Three-Way Catalyst, MPFI with OBD2
25	Zero Emitting Vehicle

The basic emission rates for these groups were cloned from technology group 15 which represents multi-point fuel injected vehicles certified to the 0.25 grams per mile (g/mi.) hydrocarbon (HC), 3.4 g/mi. carbon monoxide (CO) and 0.4 g/mi. oxides of nitrogen (NOx) standards. This is referred to as the Tier 1 standard in this memorandum. Since technology groups 15, 21, 22, 23 and 24 have 50,000 mile durability emission standards, the LEV_I emission rates were estimated by taking the ratio of the LEV_I/Tier 1 standards and applying this ratio to the technology 15 emission rates. This methodology was also used in MVEI7G for estimating the emission rates for LEV_I vehicles. In EMFAC2000, the zero mile rates for LEV_I vehicles are based on test data collected during CARB's new vehicle audit or Title 13 program. In this program, new vehicles are randomly tested to ensure compliance with the appropriate emission standards. Table 4.8-4 shows the emission rates for vehicles certified to the TLEV and LEV emission standards. Also shown are emission rates from a Honda ULEV that was tested with approximately 4,400 miles on the odometer. These emission rates were assumed to be representative of the zero mile rates from LEV_I vehicles in the normal emissions regime. Since the NOx standard is the same for both LEV and ULEV vehicles, the NOx emission rate from LEV vehicles was also applied to ULEV vehicles. Table 4.8-5 shows the basic emission rates for technology groups 22-24. Modes 1-3 represent bag 1-3 emission rates as measured during the FTP. Modes 4 and 5 represent emission rates from the first two bags of the Unified Cycle test procedure.

The regime growth rates for LEV_I vehicles are also based on the behavior of technology group 15. This assumes that the distribution of normal, moderate, high, very high and super emitters as a function of vehicle mileage is the same in both technology groups. This assumption is predicated on the fact that vehicles with like technologies will exhibit similar malfunctions (as a function a vehicle mileage), and hence have similar regime growth (deterioration) rates. The regime growth rates for LEV_I vehicles equipped with On-Board Diagnostic (OBD2) systems were further modified by restricting the growth of high, very-high and super emitting vehicles for the first 70,000 miles. This is predicated on the assumption that the vehicle will be repaired immediately during the 70,000-mile warranty period. This will prevent the growth of high, very high and super emitting

vehicles during the 70,000-mile warranty period. This same assumption was used also used in MVEI7G to estimate the emission rates from LEV_I vehicles.

4.8.3 Discussion

The methodology used in estimating the LEV_I emission rates in EMFAC2000 is the same as that used in MVEI7G. The only exception being the usage of new vehicle audit data to represent zero mile rates from normal emitting LEV_I vehicles. There was considerable internal debate whether the high, very-high and super emission levels should be adjusted by the ratio of the LEV_I/Tier 1-emission standards or should be at the same emission levels as Tier 1. However, staff is of the opinion that malfunctions in LEV_I vehicles will result in small emissions increases due to the OBD2 system, which will reduce/prevent catastrophic failures.

Category	MFG	MODEL	YEAR	Wt-HC	WT-CO	WT-NOx	Bag1-HC	Bag1-CO	Bag1-NOx	Bag2-HC	Bag2-CO	Bag2-NOx	Bag3-HC	Bag3-CO	Bag3-NOx
TLEV	Mazda	626LX	95	0.112	1.07	0.042	0.3	2.984	0.189	0.018	0.237	0.003	0.149	1.198	0.004
TLEV	Mazda	626LX	95	0.127	1.197	0.055	0.37	3.196	0.224	0.013	0.229	0.003	0.157	1.513	0.025
TLEV	Mazda	626LX	95	0.1	0.897	0.059	0.333	2.72	0.206	0.008	0.21	0.02	0.096	0.813	0.023
TLEV	Mazda	MX-6	95	0.105	1.035	0.038	0.304	2.761	0.181	0.017	0.268	0.001	0.122	1.18	0.002
TLEV	Mazda	MX-6	95	0.062	0.519	0.08	0.271	1.992	0.114	0.007	0.15	0.082	0.007	0.108	0.052
TLEV	Chry	Neon	96	0.103	0.674	0.121	0.315	2.983	0.22	0.056	0.029	0.132	0.031	0.147	0.024
TLEV	Chry	Neon	96	0.126	0.876	0.111	0.382	3.877	0.237	0.074	0.04	0.105	0.032	0.188	0.029
TLEV	Chry	Neon	96	0.118	0.732	0.178	0.342	3.189	0.355	0.071	0.044	0.163	0.035	0.174	0.072
TLEV	Chry	Neon	96	0.094	0.619	0.119	0.34	2.722	0.365	0.03	0.025	0.074	0.028	0.149	0.02
TLEV	Chry	Neon	96	0.114	0.762	0.198	0.354	3.431	0.234	0.062	0.028	0.259	0.031	0.135	0.055
TLEV	Nissan	Altima	95	0.136	1.53	0.123	0.514	6.271	0.227	0.037	0.302	0.053	0.038	0.264	0.178
TLEV	Nissan	Altima	95	0.082	1.368	0.169	0.342	5.827	0.198	0.01	0.166	0.17	0.23	0.274	0.145
TLEV	Nissan	Altima	95	0.126	1.417	0.103	0.473	5.656	0.25	0.036	0.317	0.039	0.033	0.294	0.112
TLEV	Nissan	Altima	95	0.109	1.26	0.119	0.39	5.063	0.282	0.039	0.307	0.028	0.03	0.202	0.168
TLEV	Nissan	Altima	95	0.112	1.569	0.213	0.463	6.917	0.209	0.019	0.0163	0.204	0.022	0.189	0.234
TLEV	Hynd	Scoupeis	95	0.4	0.357	0.108	0.182	1.199	0.093	0.002	0.144	0.088	0.004	0.123	0.156
TLEV	Hynd	Scoupeis	95	0.038	0.396	0.142	0.175	1.476	0.131	0.002	0.128	0.123	0.004	0.088	0.187
TLEV	Hynd	Scoupeis	95	0.066	0.566	0.048	0.314	1.694	0.077	0	0.306	0.018	0.003	0.204	0.082
TLEV	Hynd	Scoupeis	95	0.048	0.358	0.395	0.225	1.208	0.169	0.002	0.143	0.523	0.003	0.123	0.322
TLEV	Hynd	Scoupeis	95	0.038	0.316	0.482	0.169	1.064	0.497	0.002	0.129	0.414	0.004	0.103	0.597
Emission rates for Normals In Califac				0.1108	0.8759	0.14515	0.3279	3.3115	0.2229	0.02525	0.160915	0.1251	0.05295	0.36435	0.12435
Emission rates for Normals In Califac				0.104	0.803	0.305	0.295	4.323	0.499	0.027	0.625	0.147	0.05	1.161	0.214
Category	MFR	MODEL	YEAR	WT-HC	WT-CO	WT-NOx	Bag1-HC	Bag1-CO	Bag1-NOx	Bag2-HC	Bag2-CO	Bag2-NOx	Bag3-HC	Bag3-CO	Bag3-NOx
LEV	HONDA	DELSOL	96	0.05730	0.74257	0.01929	0.19391	1.56344	0.2291	0.01023	0.48086	0.01103	0.04328	0.61812	0.03224
LEV	HONDA	DELSOL	96	0.06285	1.84885	0.02875	0.20304	3.47593	0.4805	0.2551	1.61191	0.02689	0.02804	1.06898	0.01767
LEV	HONDA	DELSOL	96	0.02905	0.38554	0.06153	0.09059	0.57322	0.11059	0.00984	0.35220	0.02730	0.01908	0.30740	0.08936
LEV	HONDA	DELSOL	96	0.04222	0.50320	0.04398	0.12436	0.98164	0.06970	0.01230	0.31058	0.01674	0.03664	0.50541	0.07598
LEV	HONDA	DELSOL	96	0.03245	0.77128	0.02684	0.10373	1.40896	0.04564	0.01042	0.46997	0.01754	0.02061	0.86380	0.03034
Emission rates for Normals In Califac				0.04478	0.85029	0.03608	0.14313	1.60064	0.05938	0.01366	0.64511	0.01990	0.02953	0.67274	0.04912
Emission rates for Normals In Califac				0.045	0.404	0.153	0.177	4.323	0.25	0.016	0.625	0.074	0.03	1.161	0.107
Category	MFR	MODEL	YEAR	WT-HC	WT-CO	WT-NOx	Bag1-HC	Bag1-CO	Bag1-NOx	Bag2-HC	Bag2-CO	Bag2-NOx	Bag3-HC	Bag3-CO	Bag3-NOx
ULEV	HONDA	ACCORD	98	0.03200	0.50800	0.05100	0.12700	0.80400	0.23100	0.00700	0.46600	0.00100	0.00600	0.36300	0.01000
ULEV	HONDA	ACCORD	98	0.03100	0.45400	0.05100	0.11600	0.75700	0.22100	0.00900	0.38500	0.00000	0.00900	0.35400	0.01800
ULEV	HONDA	ACCORD	98	0.03300	0.54700	0.06300	0.13000	0.95400	0.25900	0.00800	0.49700	0.00600	0.00600	0.33400	0.02300
ULEV	HONDA	ACCORD	98	0.03000	0.60000	0.05200	0.12700	1.09900	0.22000	0.00500	0.52200	0.00400	0.00400	0.36900	0.01600
Emission rates for Normals In Califac				0.03150	0.52725	0.05425	0.12500	0.90350	0.23275	0.00725	0.46750	0.00275	0.00625	0.35500	0.01675
Emission rates for Normals In Califac				0.027	0.258	0.153	0.094	2.162	0.25	0.009	0.313	0.074	0.016	0.581	0.107

Table 4.8-4 Zero Mile Emission Rates for LEV I Vehicles

Table 4.8-4 Basic Emission Rates for LEV I Vehicles

Transitional Low Emission Vehicles				Low Emission Vehicles				Ultra Low Emission Vehicles			
Tech Gp22 Normals				Tech Gp23 Normals				Tech Gp24 Normals			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	0.323	3.312	0.223	1	0.143	1.601	0.059	1	0.125	0.904	0.059
2	0.025	0.161	0.125	2	0.014	0.645	0.020	2	0.007	0.468	0.020
3	0.053	0.364	0.124	3	0.030	0.673	0.049	3	0.006	0.355	0.049
4	1.027	10.772	0.567	4	0.493	5.797	0.155	4	0.437	3.561	0.155
5	0.046	0.591	0.229	5	0.034	1.360	0.082	5	0.024	1.122	0.082
c				c				c			
Tech Gp22 Deterioration of Normals				Tech Gp23 Deterioration of Normals				Tech Gp24 Deterioration of Normals			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	0.010	0.132	0.000	1	0.006	0.132	0.000	1	0.003	0.066	0.000
2	0.000	0.072	0.000	2	0.000	0.072	0.000	2	0.000	0.036	0.000
3	0.000	0.000	0.000	3	0.000	0.000	0.000	3	0.000	0.000	0.000
4	0.010	0.132	0.000	4	0.006	0.132	0.000	4	0.003	0.066	0.000
5	0.000	0.072	0.000	5	0.000	0.072	0.000	5	0.000	0.036	0.000
c				c				c			
Tech Gp22 Moderates				Tech Gp23 Moderates				Tech Gp24 Moderates			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	0.522	7.973	1.116	1	0.313	7.973	0.558	1	0.167	3.987	0.558
2	0.087	3.857	0.341	2	0.052	3.857	0.171	2	0.028	1.929	0.171
3	0.130	4.659	0.613	3	0.078	4.659	0.307	3	0.042	2.329	0.307
4	1.583	22.777	2.722	4	0.999	22.777	1.386	4	0.567	12.617	1.386
5	0.087	3.978	0.403	5	0.067	3.978	0.273	5	0.048	2.625	0.273
c				c				c			
Tech Gp22 High				Tech Gp23 High				Tech Gp24 High			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	0.827	12.766	1.481	1	0.496	12.766	0.741	1	0.265	6.383	0.741
2	0.466	10.451	0.727	2	0.280	10.451	0.364	2	0.149	5.226	0.364
3	0.477	8.658	1.125	3	0.286	8.658	0.563	3	0.153	4.329	0.563
4	2.397	34.023	3.586	4	1.512	34.023	1.827	4	0.859	18.844	1.827
5	0.208	7.237	0.616	5	0.160	7.237	0.418	5	0.115	4.774	0.418
c				c				c			
Tech Gp22 V_Highs				Tech Gp23 V_Highs				Tech Gp24 V_Highs			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	1.595	27.110	2.338	1	0.957	27.110	1.169	1	0.510	13.555	1.169
2	1.079	30.439	1.208	2	0.647	30.439	0.604	2	0.345	15.220	0.604
3	0.796	24.088	1.768	3	0.478	24.088	0.884	3	0.255	12.044	0.884
4	4.334	64.650	5.594	4	2.735	64.650	2.848	4	1.551	35.807	2.848
5	0.321	13.746	0.820	5	0.246	13.746	0.555	5	0.178	9.068	0.555
c				c				c			
Tech Gp22 Super				Tech Gp23 Super				Tech Gp24 Super			
Mode	HC	CO	NOx	Mode	HC	CO	NOx	Mode	HC	CO	NOx
1	3.386	57.209	3.318	1	2.032	57.209	1.659	1	1.084	28.605	1.659
2	3.314	60.817	2.195	2	1.988	60.817	1.098	2	1.060	30.409	1.098
3	2.427	43.962	3.173	3	1.456	43.962	1.587	3	0.777	21.981	1.587
4	8.542	122.191	7.866	4	5.391	122.191	4.005	4	3.060	67.677	4.005
5	0.575	20.825	1.146	5	0.441	20.825	0.777	5	0.318	13.738	0.777